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NOTE ON EQUATION VII, SECTION 8 OF GAUSS'S THEORIA MOTUS.

By PROF. ORMOND STONE, University of Virginia.

$$\text{Put} \quad \tan \frac{1}{2} a \tan \frac{1}{2} b \tan \frac{1}{2} c = 1. \quad (1)$$

$$\text{By trigonometry,} \quad \tan^2 \frac{1}{2} a = \frac{1 - \cos a}{1 + \cos a}, \text{ etc.}$$

Squaring, substituting, and clearing of fractions, (1) becomes

$$(1 - \cos a)(1 - \cos b)(1 - \cos c) = (1 + \cos a)(1 + \cos b)(1 + \cos c);$$

$$\therefore \cos a + \cos b + \cos c + \cos a \cos b \cos c = 0;$$

$$\text{whence} \quad \cos a = \frac{-\cos b - \cos c}{1 + \cos b \cos c}, \quad (2)$$

and, since $\sin a = \sqrt{1 - \cos^2 a}$,

$$\sin a = \frac{\sin b \sin c}{1 + \cos b \cos c}. \quad (3)$$

Put $a = v$, $b = 90^\circ - \varphi$, $c = 180^\circ - E$; and (1) becomes

$$\tan \frac{1}{2} v \tan (45^\circ - \frac{1}{2} \varphi) \cot \frac{1}{2} E = 1,$$

which is equivalent to Gauss's equation VII. Also, (2) and (3) become

$$\cos v = \frac{\cos E - \sin \varphi}{1 - \sin \varphi \cos E},$$

$$\sin v = \frac{\cos \varphi \sin E}{1 - \sin \varphi \cos E};$$

and since, on account of the symmetry of (1), a , b , and c may be interchanged, we have also

$$\sin \varphi = \frac{\cos E - \cos v}{1 - \cos v \cos E},$$

$$\cos \varphi = \frac{\sin v \sin E}{1 - \cos v \cos E};$$

and

$$\cos E = \frac{\cos v + \sin \varphi}{1 + \sin \varphi \cos v},$$

$$\sin E = \frac{\cos \varphi \sin v}{1 + \sin \varphi \cos v}.$$